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GAS TREATMENT for the CONTROL of BLUE MOLD DISEASE of TOBACCO

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GAS TREATMENT FOR THE CONTROL OF BLUE MOLD DISEASE OF TOBACCO

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Blue mold is a constant expense and threat to tobacco growers, particularly in the Southeastern States. It is always liable to cause transplanting delays or actual plant shortage. Most serious damage has occurred in Georgia, where 80 percent of the plants were killed in 1937, 25 percent in 1938, and 50 percent in 1939. Although blue mold occurs every year in practically every plant bed from Florida to Maryland and total losses are large, individual growers have a good chance of escaping severe damage, even in an area such as Georgia. As a result, there is a tendency for them to merely sow more beds rather than to go to the bother of undertaking control measures. However, the cost of blue mold is no small item. Thus, throughout the flue-cured region, plant-bed areas have been doubled because of blue mold, and this alone means an added expense of about $5,000,000 annually. Several reasonably effective blue mold control treatments are now available: (1) The benzol gas treatment, developed in Australia, which is safe and effective but is generally regarded in this country as too costly and cumbersome to be practical; (2) the copper oxide-cottonseed oil spray, reported in 1938, and (3) the paradichlorbenzene gas treatment, a preliminary announcement of which was published by the authors in 1938 and which also has been reported upon subsequently by others.

The spray treatment has the advantage of being inexpensive, and it also has an excellent physiological effect on plants that are to be transplanted. Spray treatment, however, must be started in advance of disease development, whereas gas treatment need not be started until after the disease is actually present in the bed. Theoretically, it is possible to completely eliminate blue mold from a bed by gas treatment, but practically it is doubtful whether this is ever done under actual plant-bed conditions. Numerous comparisons have been made of the spray and gas treatment, and in all these experiments satisfactory blue mold control was obtained with both. There were no measurable differences in the number of plants produced per unit area of bed, the earliness of the plants, or the field stands. It is concluded, consequently, that either the spray or the gas treatment, properly used, can be depended on to give adequate control of blue mold. It is the purpose of this leaflet to outline the simplest, most effective, and safest method of gas treatment, as determined by extensive tests conducted during the past several years.

Gas Treatment With Benzol

As has been mentioned, most growers in this country seem to regard the benzol method as impractical. One of the chief reasons appears

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to be the difficulty of handling a liquid in tobacco beds, particularly if they are more than 3 or 4 yards wide. Very satisfactory blue mold control has been obtained with treatments twice a week, using benzol at the rate of 5 quarts per 100 square yards of bed; an evaporating pan surface equal to 1/100 of the bed area, supplemented by cloth wicks in cool weather, to insure complete vaporization, the pans being placed not more than 8 to 10 feet apart; and heavy muslin cover (60 to 65 thread count) weighing about 4½ ounces per square yard.

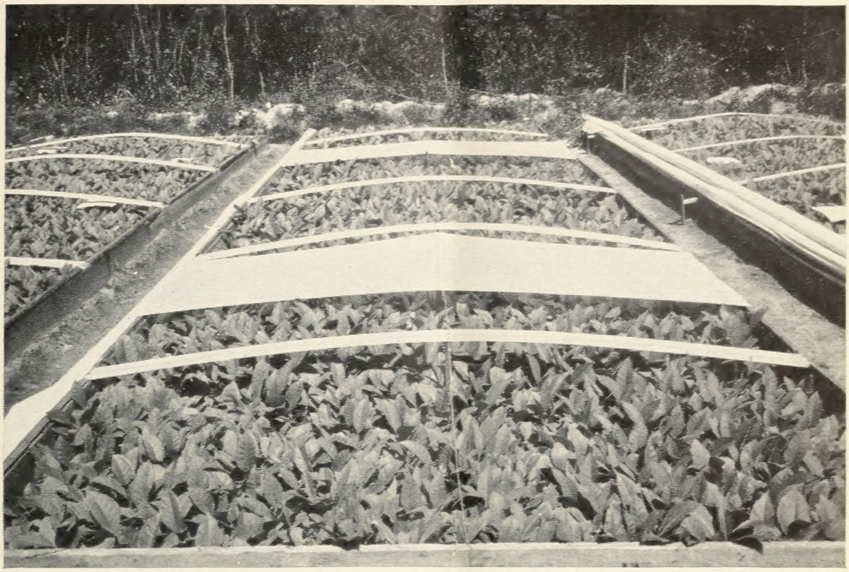

Figure 1.—Bed arranged for paradichlorbenzene treatment. In this method the crystals are scattered on tobacco-cloth strips that are stretched across the bed 15 feet apart. The strips do not interfere with the growth of the plants beneath.

Gas Treatment With Paradichlorbenzene

Paradichlorbenzene has the advantage over benzol of being much more convenient to use and, furthermore, treatment of the usual wide plant bed is not difficult. However, the margin of safety is much less with paradichlorbenzene than with benzol, and the problem of vaporization is somewhat more complicated.

Distribution of the Crystals

Under most conditions, the most practical procedure is to scatter the crystals over a 24-thread-per-inch or tighter, regular tobacco cloth. As a substitute, when suitable cotton covers are not available, 1-yard wide strips of tobacco cloth or thin cheesecloth stretched across the bed at the rate of one strip to each 5 or 6 running yards can be used (fig. 1). Much better vaporization of paradichlorbenzene has been secured with the cloth strips than with board shelves or wire baskets, though satisfactory results were obtained with these methods except during very cool weather. The tobacco cloth, used either as whole covers or as strips, should be stretched well above the plants, i. e., 12 to 18 inches above the ground surface. If the cloth is down close to the plants, injury is likely to occur.

Covers

A tight cover, which will hold the vapors in and expose the plants to their action throughout the entire night, is essential to effective treatment. Excellent results have been obtained with a 62/64–thread muslin weighing about 4½ ounces per square yard. Muslins running 48 to 56 threads per inch have proved fairly satisfactory but not equal to the heavier material, and more open grades are not recommended. The vapor-retaining ability of the muslin can be greatly increased if it is soaked with water at the beginning of the treatment. Numerous tests have shown that, with a water-soaked cover, the amount of paradichlorbenzene required to control blue mold is reduced to about one-half the amount required with a dry one. Artificial wetting, however, presents two problems. First, often it is not convenient for growers to soak the covers, so that the covers are likely to be dampened rather than soaked, and, hence, the thorough sealing effect of soaking is not secured. Second, the use of water-soaked covers increases the danger of plant injury. Injury may occur on warm nights because of excessive vaporization of the paradichlorbenzene during the early evening, and the use of wet covers under such conditions greatly increases the danger of injury. To meet this situation, growers when making use of wet covers can either omit the wetting on warm nights, or else start the treatment very late, at 7:30 to 8 p. m. It should be noted that new covers cannot be thoroughly wet until the sizing has been removed by washing them with soap and water. The muslin cover should be sewed in one piece and made somewhat larger than the outside dimensions of the bed.

Size of Crystals and Amounts to Use Per Treatment

A grade of crystals commonly referred to as No. 6, which averages 400 to 500 particles to a ¼-ounce sample, is recommended. Smaller size grades could be used to good advantage on very cool nights, and still larger grades are satisfactory in warm weather, but No. 6 has proved the best on the average. Occasional undesirable lots of paradichlorbenzene contain much fine dust. The small particles may cause injury either by sifting through the cotton on to the plants or by vaporizing too rapidly. If the cover is not soaked with water at the beginning of the treatment, the proper dosage is 2½ to 3 pounds per 100 square yards of plant bed; with water-soaked covers, 1½ pounds is adequate. Note, however, that these amounts are recommended in connection with a good grade of muslin cover as previously defined.

Duration of Treatment

During cool, cloudy weather, treatments can be started as early as 4 p. m., but on bright warm days 7:30 p. m. is early enough. In general, treatment should start about sundown, and the beds should be opened about 8 a. m. Unless disease conditions make it imperative, treatment on cold, windy nights should be avoided. It is dangerous to allow the muslin cover to remain in place during the day, even if it is cloudy, because exposure of a wet cover to sunshine for even a short period may result in severe plant injury.

Number of Treatments

The gas treatment will check disease development even after the mold has made its appearance. However, it is not safe to delay treatment too long, particularly when one muslin is to be used on several beds. In general, it is advisable to begin as soon as the disease appears in the vicinity and to follow some regular schedule, because growers are often too busy to be able to keep disease developments under close observation and these developments sometimes occur with unexpected rapidity. The number of treatments required per week will vary somewhat with conditions and localities. When blue mold is active under very cool conditions, as is often the case in Georgia, 3 treatments a week are advisable, and in beds where considerable disease is present at the start, treatment on 2 or 3 consecutive nights is desirable. Generally 2 treatments a week are adequate, and these should be so spaced as not to have more than a 4-day interval between treatments during periods when the disease is active. Treatments should continue as long as protection is required. In different sections and years the period during which protection has been required has varied from 2 to 8 weeks. In general, from 5 to 10 treatments have been sufficient.

Preparation of Plant Beds for Treatment

Preparation of narrow beds (2 to 3 yards wide, with board side walls 6 to 12 inches high).—If narrow beds are constructed with tight-board side walls, they can be prepared for gas treatment in a variety of ways. An important point to remember in such preparation, however, is that if the paradichlorbenzene is scattered over the tobacco cloth this must be well above the plants, because if either the cloth or the cloth and the muslin are permitted to sag down close to the plants, injury may be expected. If the side-wall boards are 10 to 12 inches high, then the cloth can be stretched flat across the bed with suitable cross supports about 5 feet apart. However, if the side-wall boards are 6 to 8 inches high, then a center ridge at least 15 inches high must be constructed to give sufficient overhead room. In general, it is most convenient to fasten the cloth with lath strips along one side and weight it on the free side with boards, poles, or ½-inch pipe. Also, a wire along the free side or a detached cover with wires on each side will work well with board beds, although these methods were developed particularly for use with log beds. An arrangement to roll the heavy muslin cover on and off the bed is advantageous, and this can readily be done with the aid of pipe or slender poles, provided the bed or bed section is not over 50 feet long.

Preparation of log beds.—Probably 85 percent of the plant beds in Georgia, South Carolina, North Carolina, Virginia, and Maryland, where blue-mold control is of major interest, have log sides and are from 5 to 10 yards wide. Such beds can be treated effectively with paradichlorbenzene, and the preparations required are simple and inexpensive. Figure 2 illustrates one system. The muslin cover is prepared by sewing a fold in the cloth on either side and running a heavy wire with loops at each end through these two folds. Four straight iron stakes three-fourths inch thick are provided for the corners, and eight clamp stakes one-half inch thick are used to hold the cloth down on the two sides. The first step in preparing a bed for treatment is to line up the logs and anchor them with a few wooden stakes. Then openings on the under side are filled with earth. Next, rows of stakes about 5 feet apart are placed in the bed and wires are stretched both ways. Occasional rigid wood supports are also helpful. In the center of the bed the wires should be 18 inches above the soil

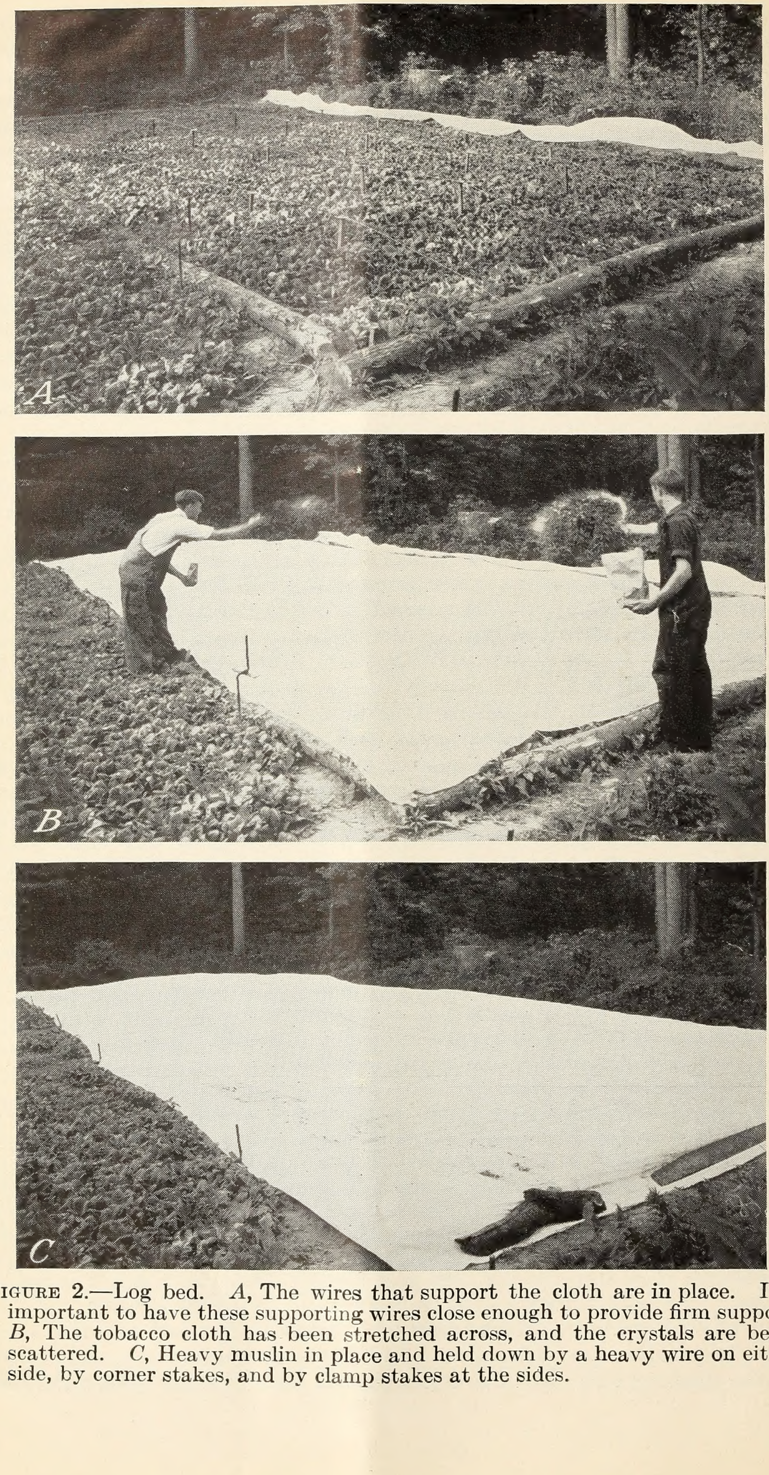

FIGURE 2.—Log bed. *A*, The wires that support the cloth are in place. It is important to have these supporting wires close enough to provide firm support. *B*, The tobacco cloth has been stretched across, and the crystals are being scattered. *C*, Heavy muslin in place and held down by a heavy wire on either side, by corner stakes, and by clamp stakes at the sides.

surface. After the bed is prepared (fig. 2, *A*), the tobacco cloth is drawn over and the muslin cover stretched along one side and fastened by two of the corner stakes; then the paradichlorbenzene is scattered (fig. 2, *B*), and the muslin is drawn over, by taking hold of the ends of the wire running through the free side. After the muslin has been tightly stretched, the other two corner stakes are driven in, the clamp stakes are pushed in, and, as this is done, any loose muslin is pulled between wire and soil surface where the clamp stakes hold it firmly. The muslin is held down at the two ends by a few poles (fig. 2, *C*). With the muslin fitting close to the ground and drawn tightly over the log tops, gas retention is excellent. It is essential, however, that the muslin be considerably larger than the plant bed.

The wired muslin cover and stakes can easily be carried from one bed to another, and a cover 8 yards wide can readily be used on a 6-yard-wide bed by merely drawing the extra cloth under the wire before clamping this to the ground. Two men are required to handle muslin covers of this type.

A second and very satisfactory method for treating log beds is shown in the cover illustration. After the side-wall logs have been lined up and the cracks filled, as described for the first method, the bed is divided by a center partition into halves. In the bed illustrated, the sections were 4 yards by 20 yards, and the pole supports were placed 2 yards apart, with a wire 15 inches above the ground running lengthwise of each of the sections. The tobacco cloth (shown at the left of the illustration) was stretched over the section to be treated and the paradichlorbenzene scattered on it. The muslin, which was fastened along the center partition, was then drawn across. The free edge of this cover had a fold with a wire running through it, and iron stakes were used at either end, with clamp stakes between, just as in the previous arrangement. Thus the same muslin was used for each half of the bed on alternate nights. Between treatments the muslin was left conveniently rolled up in the center.

Many modifications can be made in the plans suggested, and other entirely different plans can be used successfully. However, the flexible wire to hold the free side of the muslin has been of great advantage in the case of log beds and, similarly, iron stakes have proved superior to wooden because they are so much easier to drive in and pull out of the ground.

Experience Should Be Gained on Small Bed Areas

How much bed area should a grower attempt to treat who is using paradichlorbenzene for the first time?

If the paradichlorbenzene is effective and can be used with both narrow and wide beds, it would appear logical to recommend that growers treat all their beds, which might be anywhere from 100 to 1,000 square yards or more. However, this seems inadvisable for two reasons: (1) It is simple to prepare 100 square yards of plant bed for gas treatment, but as the labor and expense increase almost proportionally with the area, the situation is very different from that which obtains with the spray treatment, where, after the preliminary preparations are made, it is almost as easy to spray a large bed area as it is a small one. (2) If the paradichlorbenzene treatment is improperly carried out, serious plant injury may result. Therefore, it is advisable that the grower obtain some experience on a relatively small area.

The treatment of 100 yards of bed will actually give the average grower considerable blue mold protection, because at present only about 1 acre can be set from each 100 square yards of bed, whereas if blue mold is controlled, it is easily possible to set 3 or more acres.

Cost of Treatment

The question of the cost of paradichlorbenzene treatment is important. Because labor costs vary, only the cost of the two chief materials, muslin and paradichlorbenzene, is given. It will be assumed that one muslin cover will be used for two halves of a 100-square-yard bed during an average outbreak requiring six treatments.

Per 100 square yards of bed per year

Muslin (good for 3 years), 60 square yards at 14 cents=8.40×⅓	$2.80
Paradichlorbenzene, 18 pounds (6 treatments of 3 pounds each) at 18 cents per pound	3.24
Total cost	6.04

If a cheap grade of muslin is used the figures might be:

Muslin (good for 2 years), 60 square yards at 7 cents=4.20×½	2.10
Paradichlorbenzene, 24 pounds at 18 cents per pound	4.32
Total cost	6.42

The use of cheap muslin would tend to increase the expenditure for paradichlorbenzene and would reduce the expected life of the cover, but would hardly reduce the cost of treatment if this is considered over a period of years. It is to be understood of course that cost figures are subject to many variations, and the above merely represent estimates based on rather extensive experience.

Summary of Recommendations for the Use of Paradichlorbenzene

(1) Use a No. 6 grade of paradichlorbenzene, though a smaller grade is somewhat better in very cool weather and a larger one entirely satisfactory in warm weather.

(2) Use 2½ to 3 pounds per 100 square yards of bed if the muslin is dry or slightly moist; with a water-soaked muslin 1½ pounds is adequate.

(3) Distribute the crystals on the regular tobacco cloth that is stretched 12 to 18 inches above the ground surface.

(4) Cover with a 60- to 65-thread muslin weighing about 4½ ounces per square yard.

(5) Start treatment just before sundown and open the beds at 8 a. m. Treatments should be started earlier in cool weather and later in warm.

(6) The first treatment should be given as soon as mold is observed either in the bed or in nearby beds. Applications should be made twice a week but not on 2 consecutive nights, so that the longest period between treatments is not over 4 days. Increase the number of treatments to 3 a week during cold weather. In general, 5 to 10 treatments have been required per season.

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